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RADIAL VELOCITIES OF 30 STARS

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During the course of several years' work at this observatory a considerable number of miscellaneous measures of radial velocity have accumulated. Some of these are of spectroscopic binaries already announced, while others are of stars for which no previous measures were known. In the case of the latter, a few have been found to be variable in velocity and are so indicated in the column of remarks of the following table or in the text. Some of the binaries could with profit be continued, while others are either too uncertain for measurement or have such a small range that greater dispersion is necessary to successfully tackle them. The stars with their approximate positions for 1900, the number of plates secured, and other data are given in the following table.

Star	α	δ	Plates	Remarks
	h m	° ′		
η Piscium	1 26	+14 50	40	uncertain binary
o Ceti	2 14	− 3 26	4	
35 Arietis	2 38	+27 17	5	constant velocity
Boss 678	2 54	+51 57	5	suspected binary
Boss 744	3 12	+49 43	4	
Boss 783	3 22	+49 30	2	
Boss 839	3 36	+33 39	7	new spec. binary
42 Persei	3 43	+32 48	4	
Boss 898	3 49	+47 35	2	
Boss 947	4 01	+47 27	5	new spec. binary
ψ Orionis	5 22	+ 3 01	16	
ι Orionis	5 30	− 5 59	30	
30 Canis Majoris	7 15	−24 47	3	
Boss 2381	8 47	− 6 49	2	
36 Lyncis	9 07	+43 38	5	
ζ Leonis	10 11	+23 55	3	

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Star	α	δ	Plates	Remarks
	h m	° ′		
π 8 Virginis	11 56	+ 7 10	15	
16 Comæ	12 22	+27 22	4	
12 Canum Venaticorum	12 51	+38 52	4	new spec. binary
τ Virginis	13 57	+ 2 02	12	constant velocity, − 2
33 Boötis	14 35	+44 50	2	
10 Serpentis	15 24	+ 2 12	4	
12 Coronæ Borealis	15 52	+38 14	3	
21 Ophiuchi	16 46	+ 1 23	4	
101 Herculis	18 05	+20 01	4	
Boss 4669	18 22	+29 46	2	
50 Draconis	18 50	+75 20	28	additional measures
Boss 5070	19 47	+40 20	7	
13 Vulpeculæ	19 49	+23 50	6	
Boss 5535	21 28	+60 01	4	

η PISCIUM

(1900, $\alpha = 1^h\ 26^m{\cdot}1$, $\delta = +\ 14°\ 50'$, mag. 3·72, type G5)

In the *Astrophysical Journal*, volume XIX, page 249 and volume XXI, page 313, are given the measures of 15 plates taken by Lord at the Emerson McMillan Observatory in the years 1901 to 1905. The range shown is from +9·5 to +24·9, and Lord suspected that the star was a spectroscopic binary of long period. Giving his plates equal weight would bring the mean velocity about +16·4 km. per second.

From 1897 to 1904 there were 7 plates of the star secured at the Lick Observatory with practically no range in velocity shown. Campbell used the mean +15·5 km. per sec. as the velocity of the star, though he stated that Lord's contention of its spectroscopic character was neither proved nor disproved by his plates.

From 1904 to 1907 Küstner secured 4 plates with a single-prism spectrograph showing no appreciable range and giving a mean velocity of +14·8 km. per second.

In 1906, 1907 and 1908 there were 44 plates secured here as given in the table following. For reasons given in the column of remarks the numbers 606, 624, 1057 and 1254 have not been considered in the discussion. Of the remaining 40 plates, 16 were made with the three-prism universal spectroscope adapted for radial velocity work, 5 with the single-prism long-focus camera, and the remaining 19 with the regular three-prism long-focus camera arrangement. From our early plates it was felt that the variation was real and the period short, and a number of plates were made and measured—the labourious method of applying the Hartman-Cornu formula for each line being used—before it was suspected that some systematic error in the instrument might be the cause of the variations measured. This suspicion is probably the correct view for the universal and single-prism instruments, as in the early stages of the work they were not so perfect as later experience made them.

The range shown by the plates of the regular three-prism instrument is 11 km. but if three of these are omitted, in which only about half the usual number of lines are measured, the greatest range is about 3 km. It would appear only reasonable, then, to assume that if the star is a spectroscopic binary its range of variation is very small. On the assumption that its velocity is constant, the mean of either the universal plates or the single-prism plates is +12·3 km. per sec., while for the three-prism it is +14·1 km. per sec. Weighting the single, universal and three-prism arrangements as 1, 2 and 3 the mean velocity is +13·3 km. per second.

MEASURES OF η PISCIUM

Plate	Inst.	Date	Vel.	n	Remarks
		1906			
403	U	Sept. 27·847	+10·7	7	
		1907			
554	"	Jan. 18·543	+ 3·6	26	
562	"	" 21·550	+16·3	25	
568	"	" 22·604	+10·7	28	
584	"	" 28·526	+10·0	28	
588	"	" 30·552	+ 5·1	23	
595	"	Feb. 4·542	+16·3	17	
598	"	" 6·521	+ 6·5	29	
606	"	" 7·529	+26·4	10	plate underexposed
608	"	" 8·542	+17·9	14	
616	"	" 21·487	+ 5·2	18	
617	"	" 21·529	+18·1	23	
624	"	" 22·500	+ 3·8	20	temperature change
625	"	" 25·539	+21·4	24	
634	"	" 25·543	+18·6	24	
635	"	" 25·580	+18·5	8	
641	"	" 27·507	+10·9	25	
642	"	" 27·544	+16·0	15	
955	I L	July 18·799	+ 0·6	7	
1003	III L	Aug. 10·494	+18·4	9	
1036	I L	Sept. 6·750	+ 8·0	17	
1041	"	" 12·767	+12·9	17	
1051	"	" 18·660	+19·1	18	
1054	"	" 18·781	+13·2	19	
1057	"	" 18·885	+ 8·5	10	plate underexposed
1095	III L	Oct. 8·734	+12·2	26	
1096	"	" 8·799	+12·2	25	
1102	"	" 18·670	+13·0	16	
1103	"	" 22·647	+15·1	14	
1104	"	" 23·644	+11·8	25	
1105	"	" 23·697	+13·9	18	
1107	"	" 25·633	+13·2	19	
1164	"	Nov. 29·543	+14·3	17	
1165	"	" 29·589	+12·3	11	
1173	"	Dec. 4·577	+11·4	18	
1187	"	" 21·483	+14·1	18	

MEASURES OF η PISCIUM—*Concluded*

Plate	Inst.	Date	Vel.	n	Remarks
		1908			
1205	HH L	Jan. 1·544	+13·9	16	
1211	"	" 3·501	+10·9	10	
1254	"	" 22·516	+ 8·5	9	underexposed
1796	"	Aug. 19·840	+14·3	13	
1869	"	Sept. 7·716	+12·8	21	
1982	"	Nov. 21·688	+13·9	12	
2002	"	Dec. 5·473	+22·4	8	
2069	"	" 23·538	+20·9	10	

o CETI

(1900, $\alpha = 2^h\ 14^m{\cdot}3$, $\delta = -3°\ 26'$, mag. var., type Md)

Four spectra of this well known variable star have been made since the extended series at the December 1906 maximum. Apart from the emission band at H_β, which was present at the 1906 maximum and is not seen at the time of these observations, the other emission and absorption bands seem to be similar to those of the earlier date. The measures of the sharp H_γ and H_δ emission are fairly reliable, those for the absorption lines only approximate. H_β emission seems to appear only at the brighter maxima.

Plate	Date, G.M.T.	Absorption		Emission	
		Vel.	Lines	Vel.	Lines
6786	1915, Feb. 17·525	+50	3	+48·7	2
6834	Mar. 4·500	+58	4	+45·1	1
8655	1918, Sept. 24·703	.....	.....	+49·2	2
8659	" 30·708	+70	3	+45·3	2

MEASURES OF o CETI

λ	6786		6834		8655		8659					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4535·965	+67·5	½	+83·2	½	.....	.....	+57·8	½	.....	.....	.....	.....
4404·927	.....	.....	87·8	½	.....	.....	54·1	¼	.....	.....	.....	.....
4395·286	.....	.....	.....	.....	.....	.....	67·9	¼	.....	.....	.....	.....
4325·939	88·5	½	73·0	¼	.....	.....	.....	.....	.....	.....	.....	.....
4308·081	69·1	¼	61·0	¼	.....	.....	.....	.....	.....	.....	.....	.....
4340·654 em	78·2	1	70·9	1	+36·4	1	37·5	1	.....	.....	.....	.....
4101·890 em	+71·6	1	+63·2	1	+35·3	1	+31·5	1	.....	.....	.....	.....
Weighted mean	+ 76·24		+ 79·67		.....		+ 59·40		.....		.....	
V_o	− 25·74		− 21·39		+ 13·45		+ 10·81		.....		.....	
V_d	− ·22		− ·25		+ ·17		+ ·14		.....		.....	
Curv.	− ·28		− ·28		− ·28		− ·28		.....		.....	
Radial Velocity	+ 50·6		+ 57·8		.....		+ 70·1		.....		.....	
Emission	+ 48·7		+ 45·1		+ 49·2		+ 45·3		.....		.....	

35 ARIETIS

(1900, $\alpha = 2^h\ 37^m{\cdot}6$, $\delta = +27°\ 17'$, mag. 4·58, type B8)

No measures seem to have been published for this star. The lines of hydrogen and helium while fairly broad should give reasonable accuracy in the measures. Plate 3667 is underexposed, so that a variation in velocity cannot be said to be established.

Plate	Date, G.M.T.	Velocity	Lines
2708	1909, Aug. 2·837	+17	8
2858	Oct. 6·787	+23	7
3650	1910, Sept. 14·839	+14	8
3667	" 16·758	+35	3
8717	1919, Feb. 24·526	+19	7

MEASURES OF 35 ARIETIS

λ	2708		2858		3650		3667		8717					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	.....	.....	+ 0·3	¼	+ 1·0	¼	.....	.....	+83·6	¼	.....	.....	.....	.....
4481·400	− 9·3	¼	.....	.....	.....	.....	.....	.....	43·9	¼	.....	.....	.....	.....
4471·676	−17·6	¼	+ 5·4	¼	− 4·5	½	− 7·1	¼	38·1	½	.....	.....	.....	.....
4388·100	+ 6·7	¼	.....	.....	+ 6·7	¼	.....	.....	44·7	¼	.....	.....	.....	.....
4340·634	−21·2	½	+33·2	½	−20·0	½	+13·8	¼	48·7	½	.....	.....	.....	.....
4143·928	+ 7·2	¼	+21·0	¼	+20·0	¼	.....	.....	.....	.....	.....	.....	.....	.....
4101·890	− 6·7	¼	−24·9	¼	−13·7	¼	+30·1	¼	58·9	¼	.....	.....	.....	.....
4026·352	−19·3	½	0·0	½	−21·6	½	.....	.....	+20·0	¼	.....	.....	.....	.....
3933·825	−17·6	¼	+ 8·4	½	−17·2	½	.....	.....	.....	.....	.....	.....	.....	.....
Weighted mean	− 11·80		+ 8·52		− 9·37		+ 12·27		+ 47·16		.....		.....	
V_a	+ 28·66		+ 15·20		+ 23·24		+ 22·66		− 27·91		.....		.....	
V_d	+ ·18		− ·02		·00		+ ·11		− ·20		.....		.....	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		.....		.....	
Radial Velocity	+ 17·0		+ 23·4		+ 13·6		+ 34·8		+ 18·8		.....		.....	

BOSS 678

(1900, $\alpha = 2^h\ 53^m{\cdot}7$, $\delta = +51^\circ\ 57'$, mag. 5·42, type B5)

The star's spectrum consists of broad lines of hydrogen and traces of the magnesium λ 4481. The probable error of measurement is high, and the values given below may be as much as 10 km. in error. The H_γ line, however, is fairly uniform throughout its breadth and is thus fairly reliable, and judging by it alone there would seem to be good reason for considering the velocity of the star to be variable.

Plate	Date, G.M.T.	Number of lines	Velocity
8335	1917, Nov. 5·685	2	+11
8347	" 12·568	2	−44
8668	1918, Oct. 21·649	4	+ 3
8688	Dec. 9·638	3	± 0
8706	1919, Jan. 27·552	3	+ 4

MEASURES OF BOSS 678

λ	8335		8347		8668		8688		8706					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527					−37·8	¼	−20·9	¼	+30·2	¼				
4340·634	+ 9·8	¼	−43·0	¼	+ 6·0	¾	+13·5	½	+22·1	¾				
4101·890	+ 4·6	½	−53·3	¼	− 9·0	½	+19·7	¼	+36·3	½				
3970·177					−17·6	½								
Weighted mean	+ 6·33		− 46·43		− 9·10		+ 8·80		+ 28·19					
V_a	+ 5·08		+ 3·00		+ 12·03		− 8·58		− 23·48					
V_d	+ ·03		+ ·14		+ ·11		− ·03		− ·09					
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28					
Radial Velocity	+ 11·2		− 43·6		+ 2·8		− 0·1		+ 4·3					

BOSS 744

(1900, $\alpha = 3^h\ 12^m{\cdot}0$, $\delta = +49^\circ\ 43'$, mag. 5·08, type B3)

The hydrogen lines in the spectrum of this star are about 10 angstroms wide and thus there is considerable uncertainty in the measures. The lines λ 4471 and λ 4026 are the only ones seen of the helium series and they are very faint. It is not likely that the range shown in the measures represents a real variation in velocity.

Plate	Date, G.M.T.	Number of lines	Velocity
8331	1917, Nov. 4·787	4	− 6
8339	" 7·779	6	−32
8678	1918, Nov. 5·659	4	− 1
8689	Dec. 9·694	3	−16

MEASURES OF BOSS 744

λ	8331		8339		8678		8689							
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel.	Wt.
4861·527	− 2·4	¼	−46·5	¼	+22·3	¼	−39·3	¼						
4471·676	−46·0	⅛	−56·6	¼	−18·7	¼								
4340·634	+ 1·1	¼	−25·3	½	−23·8	½	− 5·5	½						
4101·890	−21·5	¼	−14·7	⅛	+ 3·8	¼	+43·8	⅛						
4026·352			−32·7	⅛										
3970·177			−64·8	⅛										
Weighted mean	− 13·09		− 38·11		− 8·09		− 8·12							
V_a	+ 7·55		+ 6·25		+ 7·28		− 7·88							
V_z	− ·09		− ·09		+ ·09		− ·09							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 5·9		− 32·2		− 0·9		− 16·4							

BOSS 783

(1900, $\alpha = 3^h\ 21^m{\cdot}7$, $\delta = +49°\ 30'$, mag. 5·64, type B5)

The hydrogen lines are from 10 to 15 angstroms broad and consequently the velocities obtained are only approximate. If the star is not a binary, the velocities should be about zero as it is one of the stars in the Taurus cluster. No results have hitherto been published.

Plate	Date, G.M.T.	Velocity	Lines
8357	1917, Nov. 14·661	+25	1
8694	1918, Dec. 26·564	+29	3

BOSS 839 or 40 PERSEI

(1900, $\alpha = 3^h\ 36^m{\cdot}0$, $\delta = +33°\ 39'$, mag 5·04, type B2)

The measures on the 7 plates secured here are sufficiently reliable to show that this star has a variable radial velocity. A line of unknown origin, whose wave-length has been assumed as 4070·118, is quite sharp on some of the plates.

Plate	Date, G.M.T.	Velocity	Lines
8338	1917, Nov. 7·663	+23·2	9
8428	1918, Jan. 23·490	+23·7	6
8693	Dec. 18·719	+ 3·6	7
8696	" 26·668	- 8·8	6
8698	1919, Jan. 6·506	+33·7	4
8705	" 27·484	- 8·8	7
8711	Feb. 10·631	- 1·7	6

MEASURES OF BOSS 839

λ	8338		8428		8693		8696		8698		8705		8711	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	− 7·2	¼	.....	.....	+27·8	¼	+22·3	¼	.....	.....	+17·8	¼	+20·2	¼
4471·676	+19·6	½	+48·3	½	+12·4	½	+13·0	½	+63·4	½	+33·8	¼	24·8	½
4388·100	+42·1	½	63·1	½	+ 9·6	¼	+ 1·4	½	77·1	½	+27·1	¼	13·1	¼
4340·634	+17·9	½	66·9	¼	+16·4	½	+13·1	½	33·0	½	+17·6	½	41·4	½
4143·928	+ 2·2	¾	47·1	¼	+27·4	½	− 7·1	¼	.....	.....	.....	.....	24·7	¼
4101·890	+38·6	½	.....	.....	+23·4	¼	.....	.....	+37·2	¼	+10·7	¼	+30·8	¼
4070·118	+23·1	1	37·0	¾	.....	.....	+ 6·8	½	.....	.....	− 1·3	¼	.....	.....
4026·352	− 3·4	¼	+52·8	¼	− 0·8	¼	.....	.....	.....	.....	+23·6	¼	.....	.....
3933·825	− 2·9	½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Weighted mean	+ 16·57		+ 50·04		+ 17·24		+ 8·36		+ 54·89		+ 18·40		+ 27·65	
V_3	+ 7·05		− 26·11		− 13·23		− 16·74		− 20·99		− 26·92		− 28·89	
V_4	− ·11		+ ·05		− ·14		− ·12		+ ·10		+ ·03		− ·20	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 23·2		+ 23·7		+ 3·6		− 8·8		+ 33·7		− 8·8		− 1·7	

42 PERSEI

(1900, $\alpha = 3^h\ 43^m{\cdot}2$, $\delta = +32^\circ\ 48'$, mag. 5·10, type A)

This star was announced a binary by Adams in *Astrophysical Journal*, XXXV, 174, from 4 plates in 1911. Our measures indicate that the period is short.

Plate	Date, G.M.T.	Velocity	Lines
6311	1914, Aug. 25·870	−44	7
6459	Oct. 1·802	−28	6
6468	" 2·744	+19	6
6582	Nov. 27·697	−50	4

MEASURES OF 42 PERSEI

λ	6311		6459		6468		6582							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	−59·8	¼	−49·6	¼	− 9·5	¾								
4534	68·0	¼												
4501			46·0	¼										
4481	63·4	½	54·4	½	− 5·6	½	−40·3	¼						
4340	73·1	½	43·3	¾	− 0·8	½	47·5	1						
4233			47·2	½										
4202							50·0	1						
4143					−23·6	¼								
4101	68·3	¼												
4063					+16·2	½								
4045	76·4	½												
3933	−89·0	½	−66·6	½	− 2·9	¼	−48·7	¼						
Weighted mean	− 72·73		− 51·11		− 3·24		− 47·42							
V_3	+ 28·71		+ 22·86		+ 22·57		− 2·29							
V_4	+ ·11		+ ·07		+ ·14		− ·02							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 44·2		− 28·5		+ 19·2		− 50·0							

BOSS 898

1900, $\alpha = 3^h\ 48^m{\cdot}7$, $\delta = +47^\circ\ 35'$, mag. 5·34, type B5

The helium λ 4471 and H_γ are the only measurable lines on our plates, both being very broad and ill-defined. The star belongs to the Taurus moving cluster and should have a velocity around zero.

Plate	Date	Velocity	Lines
8348	1917, Nov. 12·626	−16	2
8363	" 26·657	−14	2

BOSS 947 or 48 PERSEI

1900, $\alpha = 4^h\ 01^m{\cdot}4$, $\delta = +47^\circ\ 27'$, mag. 4·03, type B3

This spectrum was described by Frost in *Astrophysical Journal*, XVIII, 389, 1903, as having bright hydrogen lines on broader absorption bands. H_β and H_γ were doubly bright, while H_δ only faintly visible. Adams and Lasby in *Publications of the Astronomical Society of the Pacific*, 23, 240, record H_β and H_γ as being bright, presumably single as there is no mention of components. Merrill in *Lick Observatory Bulletin*, 237, describes 5 plates made in 1912, in which the emission showed sometimes as double and sometimes as single on the absorption bands. He gives a velocity, +7·1 km. per sec., for H_β emission on the plate of August 21st.

On the 5 plates secured here the emission never occurs in the double form. H_β is always present, while H_γ is absent on the third and fourth plates and very dim on the fifth plate. From measures made upon the emission lines, there seems no doubt of a real variation in velocity of the hydrogen envelope giving rise to them. Whether this can be explained through orbital motion or not cannot be stated, but the star is worthy of further investigation. The probable error for the absorption bands is so high that the velocities given, while approximate, are not to be considered as showing a variation. The absorption bands on plate 8716 are unusually faint.

Plate	Date, G.M.T.	Absorption		Emission	
		Velocity	Lines	Velocity	Lines
8306	1917, Nov. 5·723	+21	3	+ 5	2
8343	" 9·631	...	...	−11	2
8387	Dec. 22·510	− 8	4	+19	1
8716	1918, Jan. 17·607	+10	4	−30	1
8718	" 24·570	+ 2	3	−10	1

MEASURES OF BOSS 947

	8336		8343		8387		8716		8718					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1471·676	.....		.....		−30·8	¼	+44·3	¼						
1388·100	+ 2·5	¼												
1143·928	.....		.....		+34·8	¼	40·3	¼	+24·7	¼				
1101·890	14·1	¼	.....		+26·8	¼								
1026·352	+13·6	¼	.....		− 7·8	¼	25·2	¼	21·9	¼				
3033·825	.....		.....		.....		+36·6	1	31·6	¼	..			
1861·527 cm	− 5·0	1	−16·7	½	+29·5	1	− 3·2	½	+17·0	¾				
1340·634 cm	− 7·2	½	−26·7	.										
Weight														
mean	− 10·20		.....		+ 2·86		+ 36·60		+ 28·95					
V	11·08		+ 9·40		− 10·36		− 26·55		− 26·92					
V_0	·04		+ ·13		+ ·13		− ·18		− ·13					
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28					
Radial Velocity	+ 21·2		.....		− 7·6		+ 9·6		+ 1·6		..		.....	
Emission	+ 5·1		− 10·8		+ 19·0		− 30·2		− 10·3					

ψ ORIONIS

This star ($\alpha = 5^h\ 22^m$, $\delta = +3°\ 01'$) was announced a binary by Frost and Adams in 1903, and its orbit published by Plaskett in *Astrophysical Journal*, XXVIII 266, 1908. Some of the plates of this star and a number of those of ιOrionis were measured by the writer, who noted cases where the *K*-line of calcium was discrepant and where lines appeared to be double. For the purposes of the papers on "*H* and *K* lines of Calcium" and "Secondary Disturbances" given before the Ottawa Section of the R.A.S.C. sometime about 1910, the writer remeasured all the plates of these two stars where the *K*-line could be seen and where the lines were double. As these results were never published it has been thought well to give them here. In the table immediately following, the velocity of the system, + 12·0 km. per sec., has been subtracted from the measured velocities so as to get the relative orbital motion from which is deduced the ratios of the masses given in the fifth column. The second column simply gives Plaskett's velocities with 12 km. subtracted from each. From the last two columns the mean ratio of the masses is 0·63.

VELOCITIES OF COMPONENT STARS

Plate	Velocity		Lines	m_0 m
	Primary	Secondary		
1158	−157·5	+222·9	4	·71
1183	+127·1	−186·7	6	·68
1208	+133·9	−242·3	4	·55
1209	+136·0	−229·0	1	·59
1238	−126·5	+224·4	5	·56
1271	+127·9	−240·7	2	·53
1304	+139·6	−226·8	1	·57
1312	+133·3	−202·5	4	·66
1317	+144·0	−198·3	4	·72
1319	+128·5	−180·8	5	·71
1336	+ 91·3	−168·7	3	·54
1347	−147·1	+245·5	4	·60
1395	−147·0	+279·8	3	·53

The K-line seems to vary, though the range is less than that for the other lines. A check plate, No. 4852 taken Feb. 23·502, 1912, agrees in the case of the main lines with the curve within the limits of the probable error, and its value for K is added in the table following. To clear the fractions, the weights assigned at the time of measurement are multiplied by 4 in the table following, in which the velocities quoted are simply those as measured relative to the sun. The error of measurement is large, but it should be within 15 or 20 km

K-LINE VELOCITY

Plate	Velocity	Weight	Plate	Velocity	Weight
1138	+82	2	1239	− 9	2
1183	+14	1	1296	− 8	2
1209	−25	2	1312	+ 4	2
1214	+55	1	1317	+53	2
1215	+55	2	1333	+33	4
1220	+23	2	1347	−94	2
1221	+81	2	1349	−65	1
1233	+16	1	4852	+12	4

ι ORIONIS

The orbit of this star ($\alpha = 5^h\ 30^m$, $\delta = -5°\ 59'$) was published by Plaskett in *Astrophysical Journal*, volume XXX, 373, 1909. On a fine-grained plate, No. 4847 taken Feb. 20·469, 1912, five lines belonging to the secondary component were measured and from these a ratio of the masses of 0·58 was obtained. Unlike ψ Orionis the *K*-line velocity seems constant, or at least of very small range. The weighted mean velocity for 30 plates, using the wave-length 3933·825, is + 30·1 km. per second, agreeing closely with that for the velocity of the system, + 21·3 km. per second. Here, as in ψ Orionis, the weights published are four times those given at measurement.

VELOCITY *K*-LINE

Plate	Velocity	Weight	Plate	Velocity	Weight
1076	+12·6	2	1162	+16·1	2
1077	39·6	3	1170	23·2	4
1078	43·6	3	1190	24·4	4
1112	36·8	3	1194	35·6	2
1116	12·0	1	1201	55·2	1
1119	28·4	1	1207	17·2	1
1120	21·2	2	1212	43·7	4
1122	34·6	1	1213	43·6	3
1123	36·0	4	1219	37·7	2
1124	41·3	2	1263	19·9	3
1125	32·9	4	1266	11·0	2
1126	9·1	1	1275	26·7	2
1136	20·6	2	1277	18·2	2
1143	26·8	2	1278	38·4	2
1148	+27·6	4	4847	+32·9	2

30 CANIS MAJORIS

(1900, $\alpha = 7^h\ 14^m{\cdot}5$, $\delta = -24°\ 47'$, mag. 4·40, type 0e5)

This star was announced a spectroscopic binary by Frost in a footnote in *Astrophysical Journal*, XXIII, page 265. Later Lee gave the velocities of five plates in *Astrophysical Journal* XXXIX, page 45. Four measures are also given by Campbell in *Lick Observatory Bulletin*, 199. The star would be a profitable and easy one to work up here but for its southern declination.

Plate	Date, G.M.T.	Velocity	Lines
8383	1917, Dec. 11·833	+32	2
8408	1918, Jan. 3·733	+71	2
8453	Feb. 20·604	+ 1	3

MEASURES OF 30 CANIS MAJORIS

λ	8383		8408		8453							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	.....	...	.....	...	+28·6	¼						
4471·676	+25·7	¼	+76·2	¼	15·4	¼						
4340·634	+ 8·6	¼	+49·7	¼	+ 6·8	¼						
Weighted mean	+ 20·00		+ 67·37		+ 13·07							
V_2	+ 11·96		+ 4·33		− 12·22							
V_4	− ·09		·00		− ·02							
Curv.	− ·28		− ·28		− ·28							
Radial Velocity	+ 31·6		+ 71·4		+ 0·6							

BOSS 2381

(1900, $\alpha = 8^h\ 46^m{\cdot}6$, $\delta = -6°\ 49'$, mag. 5·60, type A2)

This star was announced as a spectroscopic binary by Adams in *Publications of the Astronomical Society of the Pacific*, XXVI, 261.

Our two measures follow:—

Plate	Date, G.M.T.	Velocity	Lines
7972	1917, Dec. 29·807	+49	9
8000	1918, Jan. 16·773	+33	4

MEASURES OF BOSS 2381

λ	7972		8000											
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1584·018			- 1·6	1										
1572·156	- 42·3	½												
1563·939	25·5	½												
1549·766	30·0	1	21·6	½										
1481·400	43·9	1	35·5	1										
1340·634	16·8	½												
1325·939	12·2	½												
1271·760	40·4	½	+ 8·2	1										
1233·328	10·8	½												
1045·975	- 28·0	½												
Weighted mean	- 32·04		+ 23·66											
V_0	- 17·06		+ 9·48											
V_1	·00		− ·04											
Curv.	·28		− ·28											
Radial Velocity	- 48·8		+ 32·8											

36 LYNCIS

(1900. $\alpha = 9^h\ 07^m{\cdot}3$, $\delta = +\ 43°\ 38'$, mag. 5·30, type B8)

While no range is shown in our measures, Jordan at the Allegheny Observatory gets a range of 20 km. on 7 plates from + 4 to + 24—so the star is probably a spectroscopic binary as the lines are narrow and well adapted for measurement.

Plate	Date, G.M.T.	Velocity	Lines	Weight
6939	1915, April 20·603	+13·8	6	4
6953	" 26·612	+19·5	3	2
6978	May 10·577	+17·5	9	5
6993	" 14·575	+15·2	6	4
8511	1918, April 24·592	+10·7	4	2

MEASURES OF 36 LYNCIS

λ	6939		6953		6978		6993		8511					
	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt
4572·156					+63·1	½								
4549·766	+31·6	1	+47·0	½	41·4	¼	+34·4	¼	+45·6	½				
4481·400	38·5	¼	41·2	½	30·0	¼	36·4	½	26·4	¼				
4440·634	50·6	¼			38·0	1	45·0	1	43·6	¼				
4338·084							41·5	½						
4233·328					55·3	½			+32·7	½				
4131·047					52·5	½								
4128·243	42·0	½	+50·4	½	54·3	¼								
4101·890	44·7	½			46·6	½	46·4	½						
3933·825	+42·2	½			+36·8	½	+32·7	½						
Weighted mean	+ 40·70		+ 46·50		+ 43·80		+ 41·03		+ 37·73					
V_a	− 26·44		26·59		− 25·89		25·42		− 26·58					
V_r	− ·43		·17		+ ·17		+ ·18		− ·13					
Curv.	− ·28		− ·28		+ ·28		+ ·28		− ·28					
Radial Velocity	+ 13·8		+ 19·5		+ 17·5		+ 15·2		+ 10·7					

ζ LEONIS

(1900, $\alpha = 10^h\ 11^m{\cdot}1$, $\delta = +23°\ 55'$, mag. 3·65, type F)

This star was announced a binary by Campbell in *Lick Observatory Bulletin*, 199. Our measures follow:

Plate	Date, G.M.T.	Velocity	Lines
5325	1913, Jan. 27·734	−12·7	10
5331	" 28·722	−16·3	9
5342	Feb. 3·857	− 8·5	5

MEASURES OF ζ LEONIS

λ	5325		5331		5342									
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4395·286	−26·0	½	..		..									
4352 ·906	14·7	¼	−36·4	½	..									
4340·634	14·4	¾	11·6	½	− 3·7	½								
4325·939	.	.	24·8	½	....	...								
4271·760	18·9	½	29·3	½	−11·3	½								
4198·494	4·8	½	0·8	½	.. .	.								
4143·928	40·5	½	36·2	½	−30·4	½								
4101·890	20·7	¾	25·0	½	.. .	.								
4063·756	39·1	½	....		−20·0	½								
4045·975	24·5	½	36·2	¾	....	..								
4005 597	−18·6	½	−21	½	+ 3·7	½								
Weighted mean	− 22·11		− 25·24		− 14·12									
V_a	+ 9·64		+ 9·13		+ 6·09									
V_d	+ ·07		+ ·08		− ·17									
Curv.	− ·28		− ·28		− ·28									
Radial Velocity	− 12·7		− 16·3		− 8·5									

8 VIRGINIS

1900.0 α = 11h 55m 7.8 δ = + 7° 16′ Mag. 4.57 Type A5

This star was announced a spectroscopic binary by Albrecht in *The Observatory Bulletin* V. 175, from three plates in 1909 giving a range from − 18 to + 21. In *Astrophysical Journal* vol XXXIX 46, Lee gave the measures of four plates made in 1906, 1907 and 1909 showing a variation from − 6 to + 32. Two plates were made here in 1910 and their measures published in the Chief Astronomer's report for 1911. Their velocities are slightly changed in the table below to agree with the different wave-lengths used in the recent measures. The thirteen observations now combined all give quite negative velocities and it would appear that the two when positive velocities are possible is very short relative to the whole period; a condition which would obtain if the eccentricity were fairly high and ω around zero. The velocity of the system would seem to be about 20 km. per sec. negative. The lines are only fair for measurement on our single-prism plates. The measures follow.

Plate	Date G.M.T.		Velocity	Error
3349	1910, Mar	18 868	26·0	3
3383	April	11 702	21·8	3
8066	1917, Feb	18 896	16·9	12
8078	"	27 830	26·4	10
8085	Mar	1 751	35·8	13
8094	"	2 830	29·8	9
8133	"	30 727	26·4	6
8136	April	3 691	35·2	6
8139	"	8 580	33·7	9
8145	"	10 642	14·2	8
8147	"	16 744	30·7	9
8152	"	22 578	30·2	10
8155	"	23 702	42·5	7
8159	"	24 676	30·7	7
8166	May	1 772	35·7	4

MEASURES OF 8 VIRGINIS

λ	.549		.558		8066		8078		8085		8094		8133	
	V–1	W	V–1	W	V–1	W	V–1	W	V–1	W	V–1	W	V–1	W
1584·018	–41·9	4							46·6	2	–42·9	2	45·3	4
1549·745	18·2	1	–29·6	4	29·8	1	–9·4	3	65·0	1				
1534·158											–23·8	4		
1515·508									29·6	1	18·7	4		
1501·447									14·7	3	13·4	3		
1481·477	27·5	4			26·5	1	10·3	1	55·8	4	38·2	3		
1395·456									56·7	3	11·4	4	–37·7	4
1340·645			0·0	12	47·1	4	16·5	4					+43·7	3
1325·698					52·2	1	22·9	1					22·9	1
1307·971									11·0	3				
1290·085					36·5	4	10·0	1			17·5	3	+14·—	1
1282·584														
1271·765					17·2	1			22·6	2				
1236·000							29·8	4						
1233·425					–9·2	1	62·4	2	48·4	2	34·5	4	–34·8	4
1227·107							22·3	1						
1215·738											–35·5	2		
1198·677					8·4	1			19·2	4				
1143·839			–3·1	4	29·1	2	36·8	2	65·3	2				
1071·865									37·8	4				
1063·730					40·6	1								
1045·940					25·1	1			–41·2	4				
1005·414					–23·2	1	45·6	2						
Weighted mean	– 25·13		– 9·19		– 30·27		– 55·23		– 15·74		– 37·23		– 20·55	
V.	– 0·55		– 12·10		15·69		+ 9·54		+ 8·20		+ 7·76		– 5·14	
V_1	– ·26		– ·21		– ·02		– ·12		+ ·02		– ·00		– ·09	
Curv	– ·28		– ·28		– ·28		– ·28		+ ·28		– ·28		– ·28	
Radial Velocity	– 26·0		– 21·8		16·9		26·4		35·8		– 29·8		– 26·4	

MEASURES OF π 8 VIRGINIS—*Concluded*

λ	8136		8139		8143		8147		8152		8155		8159	
	Vel.	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018							−11·5	¼	−22·7	½				
4572·190	−21 1	½	−11·1	¼									− 9·6	¼
4563·939					−49·7	¼								
4549·743	19·1	½			34·6	¼	24·5	½	− 8·7	½	−27·5	½	+17·6	½
4481·477	23·5	¼	26·4	½	32·7	¼	23·9	¼	−10·2	¾	33·9	½	−30·2	½
4351·977							14·6	¼						
4340·645	5·2	¼	13·2	½	33·8	½	14·4	¼	−15·0	½	10·6	½	−24·5	½
4325·098					21·2	¼	31·6	¼			18·3	½	−27·0	½
4307·974					38·6	¼			− 7·8	½	29·2	½	+12·4	¼
4300·211	52·1	½									22·9	¼		
4294·359														
4290·053			34·0	¼					+10·6	½				
4282·584									− 5·2	½				
4246·996											−30·8	½		
4236·000							10·6	¼	−12·2	½			−16·1	¼
4233·425			18·2	¼										
4227·107			38·4	¼										
4215·733			31·4	¼										
4101·898			21·4	¼	23·9	¼								
4071·865					−21·7	¼	0·0	½	−37·9	½				
4045·940	−26·9	¼	−38·5	¼			−18·1	¼	−23·2	½				
Weigh. l mean	− 26·67		− 24·84		− 32·20		− 15·82		− 13·10		− 24·74		− 12·57	
V_0	− 8·36		− 10·73		− 11·69		− 14·43		− 16·90		− 17·35		− 17·74	
V_4	+ ·14		+ ·14		+ ·03		− ·21		+ ·09		− ·16		− ·11	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 35·2		− 35·7		− 44·2		− 30·7		− 30·2		− 42·5		− 30·7	

16 COMÆ

(1900, $\alpha = 12^h\ 22^m{\cdot}0$, $\delta = +27^\circ\ 22'$, mag. 5·04, type A2)

The hydrogen lines and the calcium *K* are very strong in this spectrum, the magnesium λ4481 fairly strong, while numerous other metallic lines are faint and hard to measure. The results, which are the means of two independent measures, do not establish a variable velocity.

Plate	Date, G.M.T.	Velocity	Lines
6941	1915, April 20·666	± 0	11
6974	May 9·704	− 4	11
6995	" 14·676	−13	14
7062	June 17·594	− 4	15

MEASURES OF 16 COMÆ

λ	6941		6974		6995		7062					
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018							+15·7	½				
4572·190			+10·4	¼								
4549·743	+ 2·1	½	+17·6	½	+ 2·0	½	+26·2	¾				
4534·158							+34·1	½				
4508·445							− 6·9	½				
4481·477	+14·0	½	+19·2	½	+17·2	½	+31·8	¾				
4415·345							+39·6	½				
4404·861							+30·8	¼				
4351·977	+43·0	¼										
4340·645	+26·0	1	+ 3·1	½	− 0·8	¼	+34·3	½				
4325·698					+ 4·8	¼	+30·3	¾				
4307·974	+ 5·8	½					+33·3	½				
4250·586												
4233·425	+32·5	½	+21·0	½	+25·6	½						
4227·107					−21·6	¼						
4202·192			+28·1	¾	+31·9	¼						
4198·677			+28·4	¼	+13·8	¼						
4143·839							− 4·5	¾				
4128·211	+36·5	¼			+18·6	½						
4101·898	− 1·6	½	+ 5·6	¼	+ 2·4	¼	+40·0	¼				
4071·865					+17·2	¼	+25·9	½				
4063·730	− 2·8	½	+18·1	¼	+ 4·5	½	− 0·9	½				
4045·940	+26·1	¼	+29·0	½	+ 9·0	¼						
4005·414							+20·1	½				
3933·825	+10·6	½	− 3·8	¼	− 4·0	¼						
Weighted mean	+ 15·73		+ 17·89		+ 10·24		+ 22·96					
V_o	− 15·36		− 21·28		− 22·48		− 26·04					
V_d	− ·11		− ·16		− ·16		− ·16					
Curv.	− ·28		− ·28		− ·28		− ·28					
Radial Velocity	± 0·0		− 3·8		− 12·7		− 3·5					

12 CANUM VENATICORUM

(1900, $\alpha = 12^h\ 51^m\ 4$, $\delta = +38^\circ\ 52'$, mag. 5·39, type Ap)

This is the fainter of the pair No. 6313 in Burnham's General Catalogue, whose distance apart of 20″ seems to be constant. The stars have a common proper motion of 0″·257, and thus, if the components of the pair should differ appreciably in their radial velocities, it would suggest a binary character for at least one of them. For the brighter star Campbell quotes a velocity of − 1·6 km. per sec. in *Lick Observatory Bulletin*, 211, and Hnatek in *A.N.*, 197, 185, gives five velocities, the mean of which is + 2·0 km. per sec. Thus, a velocity in the neighbourhood of ± 0 km. per sec. may be accepted for this star. For the fainter star, here dealt with, Ludendorff gives a velocity of − 0·3 km. per sec., being the mean of 12 accordant plates and agreeing well with the result for the main star. Our results, however, reveal a variable velocity, as either the first or second plate, both of which have quite sharp and well measurable lines, gives a velocity too divergent from the other measures to consider it as constant.

Plate	Date, G.M.T.	Velocity	Lines
7028	1915, May 30·613	−14·8	16
7104	July 15·616	−21·0	14
8079	1917, Feb. 27·884	− 3·6	10
8086	Mar. 1·812	− 8·0	12

MEASURES OF 12 CANUM VENATICORUM (fainter

λ	7028		7104		8079		8086							
	Vel	Wt	Vel	Wt	Vel	Wt.	Vel	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt.
4584·018	− 8·9	1	.....		.....		−18·1	¼						
4572·156	+29·3	½	− 2·0	½	+ 5·8	½	−11·3	½						
4563·939	+29·2	1			−14·4	½								
4558·827	+ 8·0	½	.....											
4549·766	+10·7	½	− 6·5	½	−10·6	½	−20·5	½						
4534·139					11·5	½								
4481·400					+ 4·0	½								
4468·663	+21·2	1	+15·1	½										
4415·301	− 8·0	½	+ 7·8	¾										
4404·927	+ 9·7	1	.....		−11·8	½	−15·9	½						
4395·286	+ 4·0	½												
4383·720					−16·6	½								
4352·006			− 9·6	½	.....		−26·4	½						
4340·634			−10·3	¼	.....		+ 9·7	¼						
4325·939			− 7·5	1	−19·6	½	− 8·0	¼						
4308·081	+ 7·5	1	− 3·6	½	.....		−16·5	½						
4294·301			−10·8	½										
4289·915							−13·2	¼						
4271·760	+10·0	1	+ 7·3	½	.....		−21·8	½						
4260·640	−10·6	1												
4250·616	+ 1·3	½	+18·6	½										
4236·107			− 8·8	½			−16·5	¼						
4233·328	+ 6·2	½	+ 1·2	½	.....		+13·5	¼						
4215·668					−11·9	½								
4202·198	+ 1·1	1												
1143·928			− 9·4	½	− 4·5	½								
4045·975	+ 9·5	½												
Weighted mean	+ 7·84		− 0·95		− 9·11		12·84							
V.	− 21·65		19·52		+ 5·92		+ 5·18							
V_2	− ·09		− ·22		− ·11		− ·02							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 14·8		21·0		− 3·6		− 8·0							

τ 93 VIRGINIS

(1900, $\alpha = 13^h\ 56^m{\cdot}6$, $\delta = +2^\circ\ 02'$, mag. 4·34, type A2)

The spectrum of this star consists of broad hydrogen lines and calcium *K*, while hazy ill-defined λ 4481 and λ 4549 are also seen. Occasionally traces of other metallic lines appear, but the measures are confined to the ones above mentioned. While the range of 46 km. obtained from the measures might suggest a real variation in the radial velocity, the writer is inclined to ascribe the greatest portion of it at least to errors of measurement. Treating it as of constant velocity, we get a value − 2 km. per sec. Campbell in *L. O. B.*, 211, uses the value − 10: in his statistical treatment of the velocities of A-type stars.

Plate	Date, G.M.T.	Velocity	Lines
1342	1908, Feb. 21·88	− 9	5
1382	Mar. 4·86	+18	3
1389	" 9·81	+10	3
1399	" 16·83	− 3	3
1510	April 22·82	−12	3
1535	May 18·61	−26	3
1570	June 3·65	−15	3
2417	1909, Mar. 22·82	− 1	4
2453	" 31·80	− 1	2
2502	April 19·84	+21	·2
2512	" 23·77	+ 2	3
2532	" 28·80	−20	2

MEASURES OF τ VIRGINIS

λ	1342		1382		1389		1399		1510		1535		1570	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1861·527									−10·4	¼			−13·4	¼
4549·766									−22·3	¼				
4481·400	−49·8	¼	+17·3	¼	+18·1	¼			+ 4·5	¼	−16·0	½	+ 5·4	½
4340·634	40·4	½	−12·1	½	− 6·8	1¼	−28·6	¼			13·4	¼		
4101·890	28·8	½	+ 0·9	¼	−31·7	¼	11·6	½						
3970·177	13·6	½												
3933·825	−13·4	¼					−20·2	¼			−25·5	½	+27·0	¼
Weighted mean	− 32·34		− 1·51		− 8·74		− 18·00		− 9·40		− 19·28		+ 6·10	
V_a	+ 23·96		+ 19·89		+ 17·97		+ 15·02		− 1·90		− 6·73		− 20·61	
V_d	− ·04		− ·04		+ ·04		− ·04		− ·20		+ ·04		− ·12	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 8·7		+ 18·1		+ 10·0		− 3·3		− 11·8		− 26·2		− 14·9	

MEASURES OF τ VIRGINIS—*Concluded*

λ	2417		2453		2502		2512		2532					
	Vel.	Wt.	Vel	Wt.	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4861·527	− 6·6	½												
4549·766							+16·7	½						
4481·400	+ 6·5	½	+ 4·5	½	+24·3	½	+19·6	½						
4340·634	−22·6	½	−22·4	½	+21·1	½	− 7·3	½	−19·7	½				
4101·890	− 0·6	½							+11·2	½				
Weigh														
m	− 12·89		− 9·00		+ 22·74		+ 5·42		− 13·52					
V_a	+ 12·45		+ 8·23		− 1·09		− 3·05		− 5·49					
V_d	− ·04		− ·08		− ·22		− ·10		− ·23					
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28					
Radial Velocity	− 0·8		− 1·1		+ 21·2		+ 2·0		− 19·5					

33 BOOTIS

(1900, $\alpha = 14^h\ 35^m{\cdot}1$, $\delta = +44^\circ\ 50'$, mag. 5·39, type A)

This star was announced a spectroscopic binary by Lee, in *Astrophysical Journal*, XXXIX, page 41, from three plates giving a range of 36 km. On our plates the lines do not seem to be sufficiently dependable to attempt its orbit.

Plate	Date, G.M.T.	Velocity	Lines
6927	1915, April 14·742	+ 9	4
8187	1917, May 30·681	−15	1

MEASURES OF 33 BOOTIS

λ	6927		8187									
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·743	−13·2	½												
4481·477	+15·7	½	− 0·7	½										
4340·645	+23·7	½												
3933·825	+22·0	½												
Weighted mean	+ 12·05		− 0·70											
V	2·05		13·71											
V_1	·02		·08											
Curv	·28		·28											
Radial Velocity	+ 8·8		− 14·8											

10 SERPENTIS

(1900, $\alpha = 15^h\ 23^m{\cdot}6$, $\delta = +\ 2^\circ\ 12'$, mag. 5·12, type A5)

The lines in this spectrum are very diffuse and ill-defined. Plate 7728 is much underexposed, so that the star's variable velocity is not established by these measures.

Plate	Date, G.M.T.	Velocity	n	Weight
7030	1915, May 30·709	−23	7	2
7082	July 1·551	−30	7	2
7091	" 9·546	−35	10	3
7728	1916, " 13·545	− 4	5	2

MEASURES OF 10 SERPENTIS

λ	7030		7082		7091		7728							
	Vel	Wt	Vel.	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel.	Wt	Vel	Wt
4584·191	.....	...	.....	...	.....	...	+29·7	½					..	
4549·766	−13·0	¼	−32·6	¼	−12·2	¼	−11·6	½						
4481·400	−17·0	¼	− 1·8	¼	−19·2	¼	+49·9	½						
4468·663	− 0·1	¼												
4352·006	.....	...	+ 1·3	¼										
4340·634	+ 1·6	¼	−10·0	¼	+ 8·7	¼								
4325·939	−19·4	¼	−12·1	¼	−20·6	¼	− 1·1	½						
4308·081	.....	...	.....	...	+17·4	¼								
4289·915	.....	...	.....	...	− 0·8	¼	...							
4233·328	−18·4	¼	−11·0	¼	−17·9	¼								
4227·010	−28·1	¼	.....	...	.....	...	+21·8	¼						
4198·494	.....	...	.....	...	+ 1·2	¼								
4143·928	.....	...	.....	...	−22·2	¼								
4045·975	.....	...	+ 5·5	¼	−43·3	¼								
Weighted mean	− 13·47		− 8·66		− 10·89		+ 21·20							
V_a	− 9·42		− 21·34		− 23 48		− 24·55							
V_d	− ·09		− ·04		− ·06		− ·09							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 23·3		− 30·3		− 34·7		− 3·7							

12 CORONÆ BOREALIS

(1900, $\alpha = 15^h\ 52^m{\cdot}1$, $\delta = +38^\circ\ 14'$, mag. 5·47, type A)

The hydrogen lines in this star are fairly well defined, the other lines are more or less diffuse.

Plate	Date, G.M.T.	Velocity	Lines	Weight
6982	1915, May 10·810	−13·9	10	4
6996	" 14·740	−13·9	14	4
7036	" 31·700	−13·0	10	6

MEASURES OF 12 CORONÆ BOREALIS

λ	6982		6996		7036									
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·766	− 4·4	½	.....	...	−31·0	½								
4481·400	+ 4·8	¼	−15·6	¼	+ 5·7	¾								
4395·286	− 6·8	¼	− 9·1	¼										
4352·006	− 8·8	¼	.....	...										
4340·634	− 7·8	½	+ 1·1	½	+11·0	1								
4325·939	−20·9	½	− 4·6	¼	−16·6	½								
4289·915	− 5·2	¼	− 7·2	¼	+40·0	½								
4271·760	−13·2	½	+ 8·7	¼										
4233·328	.....	...	+ 6·3	¼										
4227·010	.....	...	− 8·8	¼										
4198·494	.....	...	−14·3	½	.....	...								
4143·928	.....	...	−23·4	¼	−30·3	1								
4101·890	−16·0	½	.....	...	− 0·5	½								
4077·885	.....	...	− 8·4	¼	−12·3	½								
4071·901	.....	...	−29·2	¼	−25·7	½								
4063·756			−31·4	¼										
4045·975	−18·0	¼	−14·6	½										
4005·355					+11·4	½								
Weighted mean	− 11·44		− 10·42		− 5·17									
V_1	− 2·07		− 3·15		− 7·53									
V_2	− ·11		− ·02		− ·02									
Curv.	− ·28		− ·28		− ·28									
Radial Velocity	− 13·9		− 13·9		− 13·0									

21 OPHIUCHI

(1900, $\alpha = 16^h 46^m \cdot 4$, $\delta = +1^\circ 23'$, mag. 5·47, type A)

The lines λ 4549 and λ 4481 are fairly good lines in this spectrum. Plate 7009 is underexposed.

Plate	Date, G.M.T.	Velocity	Lines	Weight
6985	1915, May 11·777	−27	4	2
7009	" 23·705	−25	3	1
7037	" 31·773	−33	4	1
7063	June 17·645	−32	6	3

MEASURES OF 21 OPHIUCHI

λ	6985		7009		7037		7063							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·191			−51·2	¼	−43·7	¼								
4549·766	−37·1	¼	36·0	½	31·8	¼	−29·0	½						
4481·400	40·7	¼	− 9·4	½	31·7	¼	12·9	¼						
4340·634	33·8	¼												
4325·939							17·9	¼						
4308·081							23·2	¼						
4233·328					−29·4	¼	22·5	¼						
4045·975	−22·8	¼					−37·7	¼						
Weighted mean	− 36·30		− 28·40		− 32·64		− 24·60							
V_o	+ 9·38		+ 4·05		+ 0·40		− 7·18							
V_d	·00		− ·04		− ·10		+ ·07							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 27·2		− 24·7		− 32·6		− 32·0							

101 HERCULIS

1900, $\alpha = 18^h\ 04^m\ 6$, δ [illegible] 20° 01′, mag. 5·24, type A2

The lines in this spectrum are excellent for measurement. No variation is indicated by the measures which follow.

Plate	Date, G.M.T.	Velocity	Lines	Weight
	1915, May 9·842	16·6	10	10
6976	" 13·770	9·8	12	12
6980	" 29·711	21·7	15	12
7021	June 25·642	19·7	17	15
7075				

MEASURES OF 101 HERCULIS

λ	6976		6980		7021		7075							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549·746	−36·2	1	−33·7	1	−30·9	1	6·6	1						
4534·139							28·1	½						
4481·404	29·8	1	40·2	1	34·4	1	16·9	1						
4415·333					24·0	1	7·8	½						
4404·857							22·9	1						
4395·147							10·1	1						
4351·991							8·8	½						
4340·667	36·8	1	32·2	1										
4325·707	57·0	1	52·7	1	48·7	½	30·0	1						
4307·980					46·7	½	31·5	1						
4290·070					41·0	½	22·5	1						
4271·645					31·3	1	21·4	1						
4250·087							28·0	1						
4235·[illegible]					25·7	½	18·6	1						
4233·421	28·3	1	24·7	1	32·0	1	19·0	1						
4227·124					31·3	½								
4202·278					37·5	½								
4198·719	24·3	1	39·4	1										
4143·839	26·0	1	32·8	1	24·6	1	7·0	1						
4101·890			37·6	1										
4077·862	35·9	1	33·0	1										
4071·861							23·5	1						
4063·706			30·5	1	19·3	1								
4045·929	18·0	1	37·7	1	26·0	1	−13·8	1						
4005·402	−18·6	1	−29·2	1	26·6	1								
Weighted mean	− 31·09		− 35·31		29·94		18·97							
V_a	+ 14·82		+ 13·73		+ 8·85		0·60							
V_2	− ·04		+ ·10		+ ·11		·11							
Curv.	− ·28		− ·28		·28		·28							
Radial Velocity	− 16·6		− 21·8		− 21·3		19·7							

BOSS 4669

(1900, $\alpha = 18^h\ 22^m{\cdot}1$, $\delta = +29^\circ\ 46'$, mag. 5·71, type A)

While the two plates secured are not sufficiently exposed they show the stellar lines to be sharp and very suitable for measurement. The star has been announced as a binary by Adams.

Date, G.M.T.	Velocity	Log
1917, Sept. 24·551	−7·6	10
" 26·557	9·8	6

MEASURES OF BOSS 4669

λ	8305		8310									
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1584·018	+ 4·0	¼												
1572·190	23·0	¼												
1549·743	17·8	1	+ 8·7	½										
1534·158	.....	.....	− 2·1	½										
1481·477	1·3	1	+ 4·4	1										
1325·698	10·0	½	+16·1	½										
1236·000	0·2	½												
1233·425	21·2	¼												
1143·839	11·5	¾	+11·5	¾										
1071·865	14·4	½												
1045·940	+10·9	½	+14·4	½										
Weighted mean	+ 10·60		+ 8·43											
V_a	− 17·74		− 17·80											
V_d	− ·14		− ·15											
Curv.	− ·28		− ·28											
Radial Velocity	− 7·6		− 9·8											

ADDITIONAL OBSERVATIONS OF 50 DRACONIS

The orbit of this star was published by the writer in the *Dominion Observatory Publications*, volume II, page 123, and therein it was indicated that further observations would be made to improve the value of the period which was determined solely from one season's observations.

To the 32 plates obtained in '14 were added eight in 1915 and twelve in 1916, and from these 52 plates a solution was made which changed the value of the period from 4·120 days to 4·118 days and made small changes in the other elements. Eight plates have been obtained at odd times since then and these would indicate an even smaller value for the period, namely 4·1175, which is thus given as the best value from all the observations.

With the exception of T, the time of periastron passage, which was adjusted to conform to the revised period, the other elements from the solution of the 52 plates have been retained and are as follows:

$$
\begin{aligned}
P &= 4{\cdot}1175 \text{ days} \\
e &= {\cdot}012 \pm {\cdot}009 \\
K_1 &= 79{\cdot}42 \text{ km.} \pm 0{\cdot}97 \text{ km.} \\
K_2 &= 83{\cdot}90 \text{ km.} \pm 0{\cdot}97 \text{ km.} \\
\gamma &= -8{\cdot}79 \text{ km.} \pm 0{\cdot}49 \text{ km.} \\
\omega_1 &= 107°{\cdot}6 \pm 8°{\cdot}9 \\
\omega_2 &= 287°{\cdot}6 \pm 8°{\cdot}9 \\
T &= \text{J. D. } 2{,}420{,}293{\cdot}519 \pm {\cdot}102 \\
a_1 \sin i &= 4{,}480{,}000 \text{ km.} \\
a_2 \sin i &= 4{,}750{,}600 \text{ km.} \\
m_1 \sin^3 i &= {\cdot}95 \\
m_2 \sin^3 i &= {\cdot}90
\end{aligned}
$$

The probable error of a plate is $\pm$ 4·6 km. per sec. for component I, and $\pm$ 4·8 km. per sec. for component II. The table of measures following is a continuation of the table on page 123 of the volume mentioned above, but the phases there given, if used, should be revised to suit the new P and T.

ADDITIONAL MEASURES OF 30 DRACONIS

Plate	Observer*	Date	Julian Date	Phase	Component I				Component II			
					n	Wt.	Vel.	O-C	n	Wt.	Vel.	O-C
		1915										
7124	C	July 26	2,420,705·770	·501	4	3	− 81·6	− 3·0	5	4	+ 58·5	− 6·7
7133	H	" 29	708·721	3·452	2	2	+ 44·0	− 0·3	4	3	− 59·7	− 5·2
7144	H	Aug. 9	719·682	2·061	5	4	− 8·5					
7163	Y	" 23	733·611	3·639	2	1·5	+ 45·6	+19·2	3	2	− 49·8	− 4·8
7179	Y	" 27	737·632	3·541	2	1·5	+ 24·9	−11·7	2	1·5	− 55·4	+ 1·0
7272	Y	Sept. 21	762·562	3·766	5	4	− 22·4					
7282	H	" 22	763·553	·639	4	3	− 83·8	+ 0·8	4	3	+ 83·2	+11·4
7290	H	" 27	768·610	1·579	2	1	− 50·9	− 8·0	2	1	+ 22·2	− 5·7
		1916										
7665	H	May 24	2,421,008·625	2·779	4	3	+ 80·7	+13·3	4	2·5	−100·7	−13·4
7671	Y	" 29	010·610	·646	3	2	− 97·7	−14·3	4	2·5	+ 79·7	+ 8·6
7674	Y	" 31	012·691	2·730	2	1	+ 71·0	+ 5·6	5	3	− 84·2	+ 2·2
7682	H	June 1	− ·550	2·589	8	6	+ 71·3	+14·0	8	5	− 70·0	+ 9·0
7720	H	July 6		·456	6	4	66·0	+ 6·3	3	2	+ 75·1	+15·7
7723	H	" 8	0	2·543	2	1·5	+ 59·5	+ 4·3	4	3	− 80·6	− 3·5
7726	H	" 9	054·778	3·639	1	1	+ 27·8	− 2·9				
7749	H	" 21	066·763	3·272	8	5	+ 62·8	+ 2·1	8	5	− 78·8	+ 3·7
7762	H	" 26	071·612	4·003	9	6	+ 5·9					
7769	H	Aug. 1	077·760	1·916	14	6	4·5					
7785	H	" 15	091·703	·707	5	3	+ 36·0	7	5	3	− 65·2	− 1·3
7788	H	" 16	092·573	·259	9	6	− 59·6	− 5·0	9	6	+ 49·6	+ 8·7
		1917										
8210	H	June 27	407·691	2·447	2	1·5	+ 58·2	+ 5·4	3	2	− 64·2	+ 9·0
8214	H	July 2	412·661	3·300	1	1	+ 49·1	− 6·6	2	1·5	− 76·0	+ 1·0
8279	H	Sept. 3	475·603	·362	7	5	− 64·8	+ 5·1	8	5	+ 57·2	+ 0·3
8301	H	" 18	490·570	2·976	6	5	+ 73·8	+ 4·5	5	4	92·9	− 1·3
8307	H	" 24	496·698	·869	2	2	− 85·2	+ 2·2	2	2	+ 59·2	− 15·0
		1918										
8654	H	Sept. 24	861·650	3·481	3	2	+ 39·5	− 0·3	2	1·5	− 54·5	+ 5·8
8658	H	" 30	867·640	1·236	3	2	− 76·9	− 4·0	3	2	+ 45·8	−12·7
		1919										
8725	H	Mar. 13	2,422,031·862	·758	1	1	−103·3	−15·5	1	1	+ 61·3	−13·5

*C = Cannon; H = Harper; Y = Young

MEASURES OF 30 DRACONIS (primary)

	7124		7133		7144		7163		7179		7272		7282	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549					15·0						18·4	½	111·5	½
1481					[illegible]		[illegible]				25·3	½		
4340			−45·9	½	−12						19·4	½	94·2	½
1308			.....		.....									
1250			.....		−24·6									
4566	89·6	½	.....		.....		.....		.....				79·8	½
1101	62·5	¼	.....		.....		.....		+18·2	½	29·7	½		
4077	86·8	½	.....		.....		.....		+21·0	½				
2663	79·8	½												
4045	101·1	½									21·0	½	−80·9	½
4563	82·8	½	−46·0	1	−15·8	½	+46·8	½						
Weighted		87·07	+	40·30	−	12·52	+	41·03	+	20·30	20·80		−	88·20
Mean		3·87	+	4·02	+	4·38	+	4·83	+	4·93	+	1·72	−	4·60
V	+	·09	−	·05	−	·05	−	·03	−	·05	−	·03	−	·05
C	−	·20	−	·28	−	·28	−	·28	−	·28	−	·28	−	·28
Resultant Velocity		81·6	+	44·0	−	8·5	+	45·6	+	24·9	−	22·4	−	83·8

MEASURES OF 50 DRACONIS (primary)—*Continued*

	7290		7665		7671		7674		7682		7720		7723	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1549	.....	...	.....	...	.....	...	.....	...	+85·5	½	−72·7	½	+64·8	½
1520	.....	...	.....	...	.....	...	.....	...	68·1	½				
181	.....	...	+71·1	½	−111·2	½	+78·6	¼	.....	...	62·8	½	+49·1	½
1340	.....	...	.....	...	.....	...	.....	...	49·3	¼	50·3	¼		
1271	.....	...	116·1	¼	.....	...	.....	...	.....	...	79·7	¼		
1260	.....	...	.....	...	.....	...	.....	...	61·6	½				
1227	.....	...	.....	...	79·6	½								
1143	.....	...	.....	...	.....	...	.....	...	70·3	¼				
1101							64·6	½						
1077	.....	...	.....	...	.....	...	.....	...	83·1	½				
1045	−61·8	½	88·9	¼	−86·2	¼	.....	...	71·5	½	63·5	½		
957·3	48·3	¼	+70·7	½	.....	...	.....	...	+79·5	¾	−84·5	¼		
Weighted mean	− 55·05		+ 81·33		− 97·00		+ 71·60		+ 71·57		− 68·50		+ 56·95	
V_1	+ 4·50		− 0·70		− 0·53		− 0·36		− 0·03		+ 2·70		+ 2·81	
V_2	− ·06		+ ·12		+ ·08		+ ·06		+ ·06		+ ·05		+ ·02	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 50·9		+ 80·5		− 97·7		+ 71·0		+ 71·3		− 66·0		+ 59·5	

MEASURES OF 50 DRACONIS (primary)—*Continued*

λ	7726		7749		7762		7769		7785		7788		8210	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584					−12·8	¾								
4563			+64·7	¼			+ 0·5	½						
4549					+17·1	¾	−24·6	¾						
4481			76·1	¼	+ 2·9	½	−19·4	¾			−58·8	½	+58·0	½
4468			48·7	¼			+ 1·2	¼						
4415											56·9	¼		
4352							− 9·5	¾						
4340			55·4	¼			−12·5	½			64·9	¼		
4325							−12·0	¾			77·4	¼		
4308					+ 4·0	½	+ 1·2	½						
4294							−11·7	¾						
4289							+ 8·6	½						
4271					− 9·2	¼					54·9	½		
4236					+ 8·6	¼	−21·1	½						
4233			73·2	¼	+20·0	½	− 1·0	¾	+29·4	¼	47·4	½		
4215					−16·6	½								
4143			63·5	¼										
4077					+11·8	½	−10·7	¾						
4063							+ 1·0	½	22·7	¼	67·7	½		
4045			45·2	½					21·8	½	71·9	½		
4005									52·2	¼				
3933	+25·2	¼	+61·2	½					+32·3	¼	−80·0	½	+53·3	¼
Weighted mean	+ 25·20		+ 59·44		+ 2·22		− 8·48		+ 31·68		− 64·03		+ 56·42	
V_a	+ 2·91		+ 3·65		+ 3·90		+ 4·19		+ 4·68		+ 4·71		+ 2·04	
V_d	− ·04		− ·05		+ ·03		− ·05		− ·05		+ ·02		+ ·03	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 27·8		+ 62·8		+ 5·9		− 4·5		+ 36·0		− 59·6		+ 58·2	

MEASURES OF 50 DRACONIS (primary)—*Continued*

λ	8214		8279		8301		8307		8654		8658		8725	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549	.....	....	−76·8	½	.....	....	−122·3	½	.....	....	−104·2	½		
4481	+46·7	¼	66·4	½	+64·9	1	− 67·6	¾	+31·2	¼	72·1	¼	−98·2	½
4415	.....	....	.....	....	78·6	½								
4340	.....	....	68·8	¼	70·9	1	.....	....	12·5	½				
4143	.....	....	.....	....	64·0	½								
4101	.....	....	74·2	½	73·2	½								
4077	.....	....	58·1	½										
4045	.....	....	69·2	¼										
3933	.....	....	−75·2	¼	+16·3	½	.....	....	+59·2	½	− 78·2	½		
Weighted mean	+ 46·70		− 69·45		+ 69·32		− 89·44		+ 34·88		− 80·96		− 98·20	
V_a	+ 2·40		+ 4·93		+ 4·78		+ 4·62		+ 4·84		+ 4·43		− 4·91	
V_d	+ ·03		− ·02		− ·04		− ·08		+ ·07		− ·07		+ ·09	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	+ 49·1		− 64·8		+ 73·8		− 85·2		+ 39·5		− 76·9		− 103·3	

MEASURES OF 50 DRACONIS (continued)

	7424		7428		7433		7463		7479		7482		7490	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4549											+70·0	¼		
4534							−51·2	½						
4340					−59·3	¼								
4308											82·4	¼		
4271					72·3	¼								
4143			−65·0	½			60·3	½						
4101	+67·5	¼									84·3	¼		
4077			63·9	½					−69·0	¼				
4063	50·8	½	44·3	½										
4045	44·4	1	47·0	½					−57·0	¾			+24·3	¼
3958					67·9	½								
3933	+59·0	1½	+58·3	1½	−61·8	1	−54·5	½			+78·8	1½	+11·6	¼
Weight		4		4		2		1		3		4		1
Mean	+	57·44	+	56·54	−	63·36	−	54·35	+	60·00	+	78·84	+	18·00
V	+	3·87	+	3·87	+	4·02	+	4·83		4·93	+	4·69	+	4·50
V		·09		·09		·05	−	·02		·05		·05	−	·06
Corr.	−	·28		·28		·28		·28		·28		·28		·28
Radial Velocity	+	57·0	+	60·0	−	59·7	−	49·8	−	55·4	+	83·2	+	22·2

MEASURES OF 50 DRACONIS (secondary)—*Continued*

λ	7665		7671		7674		7682		7720		7723		7726	
	Vel.	Wt	Vel.	Wt	Vel.	Wt	Vel	Wt	Vel.	Wt	Vel.	Wt	Vel	Wt.
4549							−64·4	½	+51·7	½	−93·2	½		
4520							62·9	½						
4481	117·0	½	+85·0	½	− 78·6	½	.....	....	74·9	½	84·6	½		
4340							60 7	½						
4325											71·8	½		
4308	84·2	½	.....	....	91·3	½								
4271	.....	....	.....	....	106·0	½								
4260					80·2	½	81·8	½						
4233	.....	....	95·0	½										
4227	.....	....	73·6	½										
4143	.....	....	.....	....	.....	....	90·3	½						
4077	.....	....	.....	....	.....	....	83·5	½						
4045	103·8	½	+63·3	½	.....	....	51·9	½	.....	....	−83·0	½		
3933	− 94·3	½	.....	....	− 54·7	½	−77·8	½	+91·2	½	.....	....	−39·2	½
Weighted mean	− 99·80		+ 80·40		−' 83·60		− 69·73		+ 72·60		− 83·15		− 39·20	
V_o	− 0·70		− 0·53		− 0·36		− 0·03		+ 2·70		+ 2·84		+ 2·91	
V_d	+ ·12		+ ·08		+ ·06		+ ·06		+ ·05		+ ·02		− ·04	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 100·7		+ 79·7		− 84·2		− 70·0		+ 75·1		− 80·6		− 36·6	

MEASURES OF 50 DRACONIS (secondary)—*Continued*

λ	7749		7785		7788		8210		8214		8279		8301	
	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt	Vel	Wt
4563	−98·0	½									·40·9	¼		
4549					+28·1	½	−74·5	¼	−82·1	½	34·2	¼	−105·8	½
4481	74·8	¼												
4468	101·4	¼			38·2	½								
4415														
4352	64·0	¼			42·6	½					38·4	¼	93·8	1
4340	84·1	¼			68·1	½			−75·5	¼				
4325					54·3	¼								
4271					54·1	·							117·8	½
4233	58·8	¼	−66·8	½									85·7	½
4143	67·8	¼									75·0	½		
4101							56·6	½			53·5	½		
4077											63·1	½		
4063			54·9	¼	59·4	½					40·1	¼		
4045			70·4	¼	40·3	½								
4005			74·4	¼										
3933	−87·7	½	−81·0	¼	+30·0	½	−76·5	¼			+60·0	¼	− 97·6	½
Weighted mean	− 82·16		− 69·50		+ 45·10		− 66·00		− 78·10		+ 52·53		− 97·10	
V_3	+ 3·65		+ 4·68		+ 1·71		+ 2·04		+ 2·40		+ 4·93		+ 4·78	
V_4	− ·05		− 05		− ·02		+ ·03		+ ·03		− ·02		− ·04	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 78·8		− 65·2		− 49·6		− 64·2		− 76·0		+ 57·2		− 92·9	

MEASURES OF 50 DRACONIS (secondary)—*Concluded*

	8397		8654		8658		8725					
	Vel.	Wt	Vel.	Wt	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
1549	+ 47·4	¾	.....	....	+41·3	¼						
1481	+ 62·4	¾	−80·2	¼	43·2	¼	+66·4	½				
3933			48·6	½	+40·8	¼						..
Weighted mean	+ 54·90		− 59·13		+ 41·77		+ 66·40					
V_o	+ 4·62		+ 4·84		+ 4·43		− 4·91					
V^A	− ·08		+ ·07		− ·07		+ ·09					
Cu_{rv}	− ·28		− ·28		− ·28		− ·28					
Radial Velocity	+ 59·2		− 54·5		+ 45·8		+ 61·3		..		..	.

BOSS 5070

(1900, $\alpha = 19^h\ 47^m{\cdot}2$, $\delta = +40^\circ\ 20'$, mag. 5·62, type A)

This star was announced as a spectroscopic binary by Adams in the *Publications of the Astronomical Society of the Pacific*, vol. 26, page 261. From the measures, the period is evidently short. The *K* line of calcium does not share in the large oscillations of the other lines. Sufficient plates for an orbit have been secured at Allegheny and the star is dropped from our list.

Our measures follow.

Plate	Date, G.M.T.	Velocity	n	Weight
6804	1915, Feb. 18·941	−23	9	3
6842	Mar. 3·910	+19	10	4
6928	April 14·803	+88	7	3
8285	1917, Sept. 6·747	−86	5	2
8290	" 8·527	+ 4	6	2
8294	" 11·631	+67	7	3
8297	" 12·653	+73	4	2

MEASURES OF BOSS 5070

λ	6804		6842		6928		8285		8290		8294		8297	
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4567·967	+11·5	¼	+ 6·6	¼	+ 99·5	¼	.....	.....	.....	.....	.....	.....	.....	.....
4552·762	−26·3	¼	+24·4	¼	+101·6	½	.....	.....	+40·9	½	+77·4	¾	+ 58·4	½
4481·400	−12·0	¼	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4471·676	−33·6	¾	+18·7	½	+ 69·6	¼	−73·1	¾	−11·0	½	+82·1	¾	+115·5	¾
4388·100	.....	.....	+28·5	¼	+ 75·4	¼	−97·0	½	+18·3	½	+65·3	¼	+ 70·0	½
4340·634	−54·4	½	− 4·5	½	+ 43·0	½	−66·4	½	+16·1	½	+77·7	¾	+ 58·9	¼
4325·939	.....	.....	+21·7	½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4267·301	−23·8	¼	+22·3	¼	.....	.....	.....	.....	.....	.....	+94·8	¼	.....	.....
4143·928	−16·1	¼	− 1·9	½	.....	.....	−78·9	¼	.....	.....	+52·0	¼	.....	.....
4101·890	−19·0	¾	+11·6	½	+ 54·6	½	−72·7	¼	− 1·9	¼	.....	.....	.....	.....
4026·352	.....	.....	.....	.....	+ 88·4	½	.....	.....	+ 1·5	¼	+72·0	¼	.....	.....
3933·825	[− 5·8	½]	[−29·0	½]	[− 6·5	½]	.....	.....	.....	.....	.....	.....	.....	.....
Weighted mean	− 26·87		+ 12·31		+ 74·47		− 77·56		+ 12·76		+ 76·56		+ 82·80	
V_a	+ 4·07		+ 7·20		+ 13·99		− 7·74		− 8·13		− 8·78		− 8·99	
V_d	+ ·22		+ ·21		+ ·21		− ·21		+ ·07		− ·11		− ·13	
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28		− ·28	
Radial Velocity	− 22·9		+ 19·4		+ 88·4		− 85·8		+ 4·4		+ 67·4		+ 73·4	

13 VULPECULÆ

(1900, $\alpha = 19^h\ 49^m{\cdot}2$, $\delta = +23^\circ\ 50'$, mag. 4·50, type A)

This star was announced a binary by Lee, in *Astrophysical Journal*, XXXII, 307, from eight plates giving a range from − 15 to − 36. Campbell used as the velocity for the star, − 28. While the lines are in general fairly sharp there is a bare suspicion that $H\gamma$ on plate 8221 is double.

Plate	Date, G.M.T.	Velocity	Lines	Weight
8202	1917, June 18·714	−37·8	1	1
8218	July 5·740	−24·2	4	2
8221	" 6·690	−30·8	2	1
8222	" 14·678	−30·4	5	2
8225	" 15·777	−32·5	5	2
8228	" 16·691	−24·1	1	1

MEASURES OF 13 VULPECULÆ

λ	8202		8218		8221		8222		8225		8228			
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4584·018							−18·6	½						
4549·743			−15·6	¼			+35·3	¼	−42·1	½				
4481·477	−50·9	¾	44·0	½	−43·1	½	+51·5	½	+24·1	½	−28·1	¾		
4340·645			25·8	¼			+33·9	½	+40·0	¼				
4233·425									+41·5	¼				
3933·825			−31·2	½	−28·6	¼	−36·6	½	−43·2	¼				
Weighted mean	− 50·90		− 31·93		− 38·27		− 35·15		− 36·70		− 28·10			
V_a	+ 13·20		+ 7·99		+ 7·64		+ 4·96		+ 4·58		+ 4·20			
V_d	+ ·14		+ ·0.		+ ·08		+ ·08		− ·08		+ ·04			
Curv.	− ·28		− ·28		− ·28		− ·28		− ·28		− ·28			
Radial Velocity	− 37·8		− 24·2		− 30·8		− 30·4		− 32·5		− 24·1			

BOSS 5535

(1900, $\alpha = 21^h\ 28^m{\cdot}3$, $\delta = +\ 60^\circ\ 01'$, mag. 5·52, type A)

This star is in Kapteyn's Area No. 18. It is listed as of A-type in *Harvard Annals*, vol. 50, but would more properly fall under the classification B2. Besides the hydrogen and helium series, there are the characteristic lines of this type at λλ 4089 and 4649 variously ascribed to argon, silicon and other substances. The third member of the group, that at λ 4116, does not appear on the plates. The three silicon lines λλ 4575·52, 4568·13 and 4552·89 are seen in the spectrum, the latter two being 0·5 as intense as $H\gamma$ or the helium λ 4471. The wave-lengths indicated for them are somewhat greater than the generally accepted values, but were adjusted to agree with the velocities obtained from the hydrogen and helium series. Other absorption lines, whose normal wave-lengths are approximately λλ 4366·9, 4620·5, 4630·7 and 4641·4, were noted but not used in the results.

Plate	Date, G.M.T.	Number of Lines	Velocity
8394	1917, Dec. 28·465	5	−28·3
8404	1918, Jan. 2·481	5	−18·7
8410	" 4·455	6	−19·4
8672	Oct. 23·605	7	−33·8

MEASURES OF BOSS 5535

λ	8394		8404		8410		8672							
	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.	Vel.	Wt.
4568·13	−14·0	½	+19·1	¼	− 9·7	¼	−38·6	½						
4552·89	12·3	½	− 1·4	¼	− 5·3	½	31·0	½						
4471·676	19·7	¾	−29·0	½	+ 1·8	½	22·3	¾						
4388·100	19·6	¼	− 2·1	¼	− 0·9	½	26·4	¾						
4340·634	−11·2	¼	+ 4·6	¼	−16·7	½	34·2	¾						
4143·928					−18·4	¼	17·3	½						
4121·016							−35·5	½						
Weighted mean	− 15·84		− 6·20		− 6·96		− 29·01							
V_a	− 12·07		− 12·07		− 12·04		− 4·42							
V_d	− ·11		− ·14		− ·12		− ·09							
Curv.	− ·28		− ·28		− ·28		− ·28							
Radial Velocity	− 28·3		− 18·7		− 19·4		− 33·8							

Dominion Observatory
Ottawa
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